

CHAPTER 4

HARDWARE

The installation of electronic equipments necessitates the use of a great many different kinds and types of hardware items to include screws, nuts, bolts, fasteners, pins, clamps, etc. There is a wide variety of hardware items to meet every requirement of size, shape, strength, and material and this paragraph presents a representative sampling of those items frequently encountered in installation work. Commercial catalogs are available from most sources listed and activities should obtain them to assist in the selection of the correct hardware items to meet particular needs. It is recommended that within budgetary constraints, the guidelines in Handbook H-28 be followed in the selection of screw threads on installation hardware. (Note that MIL-STD-454 requires that threaded fasteners and related parts with tapped holes conform with either H-28 or MIL-S-7742 requirements.)

4.1 SCREWS AND BOLTS

Representative types of common screws and bolts are shown in figures 4-1 and 4-2. Information on types and manufacturers of set screws is presented in figure 4-3. Table 4-1 gives the head dimensions for a group of common machine screws, Table 4-2 lists the standard threads per inch for national fine and national coarse threads and Table 4-3 shows the available lengths in brass machine screw and bolt lengths.

4.2 THREADED STUDS

Types of threaded studs used to anchor or mount equipment are illustrated in figure 4-4. The installation of studs requires special knowledge and tools and would not ordinarily be performed in the field. The installer should have a knowledge of the various types of studs available and installation techniques in the event it becomes necessary to replace one.

4.3 NUTS, CLINCH NUTS, AND INSERTS

Extreme care must be taken in selecting the correct type and size nut from the great variety available to fasten equipment. Premature equipment failure and hazardous operations may result from the use of improper fastening methods and hardware. Figures 4-5 and 4-6 illustrate a variety of nuts and clinch nuts. Inserts are used to change the threaded diameter of a hole or to provide strong screw threads in soft material or sheet metal. They can be installed with standard shop tools in holes punched or drilled to normal tolerances. Figure 4-7 depicts several different types of inserts.

4.4 PINS

Figure 4-8 illustrates a variety of pins which are commonly used for installation work, together with information on hole and pin sizes and shear strength. When replacing pins the installer must be careful not to exceed the prescribed shear strength as the pin may also function as a safety device.

4.5 RIVETS

A representative group of various types of rivets used in the installation of electronic equipment is illustrated in figure 4-9.

4.6 FASTENERS

Fasteners come in a great variety of types, sizes, and materials. Fasteners provide a handy means of attaching panels and removable access doors and prevent their loosening under stress or vibration. Since each type has special features, care must be taken in the selection of a particular one so that maximum utilization is obtained. Figure 4-10 illustrates some of the many types in common use.

4.7 WASHERS AND RETAINING RINGS

Washers serve to provide a proper seating of the screw head and to keep the screw head from scarring the panel surfaces. Figure 4-11 illustrates four common type washers and the dimensions for various sizes. Retaining rings are used where a loose fitting pin must be kept from falling out of the hole or where it is necessary to keep a device on its mounting shaft. See figure 4-12.

4.8 THICKNESS GAUGES

Several systems are used to denote the standard thicknesses for wire and sheet metal. Table 4-4 provides a cross reference between these systems.

4.9 DRILL AND TAP SIZES

Tables 4-5, 4-6, and 4-7 list the drill and tap sizes to be used when holes must be drilled and tapped for standard machine screws, pipe, and bolts, respectively. The dimensions for hexagonal nuts are provided in Table 4-8.

4.10 DECIMAL EQUIVALENTS

Table 4-9 presents a cross reference between fractional inches, millimeters, wire gages and letter size drills, and decimal inches. This cross reference is especially useful when comparing sizes of drill bits. Some assortments of drill bits use the traditional inch system of numbering (1/64-inch steps between drills) while other assortments use the wire gage system (80, 79, 78, etc.).

Table 4-1. Machine Screw Head-Dimensions

HEAD DIMENSIONS OF MACHINE SCREWS (INCHES)														
	#0 (.060)		#2 (.086)		#4 (.112)		#6 (.138)		#8 (.164)		#10 (.190)		1/4" (.250)	
	Dia.	Ht.	Dia.	Ht.	Dia.	Ht.	Dia.	Ht.	Dia.	Ht.	Dia.	Ht.	Dia.	Ht.
Round	.113	.053	.162	.069	.211	.086	.260	.103	.309	.120	.359	.137	.472	.175
Flat (82°)	.119	.035	.172	.051	.225	.067	.279	.083	.332	.100	.385	.116	.507	.153
Flat (100°)	----	----	----	----	.225	.048	.279	.060	.332	.072	.385	.083	.507	.110
Oval	.119	.056	.172	.080	.225	.104	.279	.128	.332	.152	.385	.176	.507	.232
Fillister	.096	.059	.140	.083	.183	.107	.226	.132	.270	.156	.313	.180	.414	.237
Truss	----	----	.194	.053	.257	.069	.321	.086	.384	.102	.448	.118	.573	.150
Binding	----	----	.181	.046	.235	.063	.290	.080	.344	.097	.399	.118	.513	.153
Pan	----	----	.167	.053	.219	.068	.270	.082	.322	.096	.373	.110	.492	.144
Cross Recessed	----	----	.167	.062	.219	.080	.270	.097	.322	.115	.373	.133	.492	.175
Hex	----	----	.145	.050	.217	.060	.287	.080	.287	.110	.361	.120	.433	.190
*In the case of the Hex Head machine screw the head diameter is actually the across-corners dimension.														

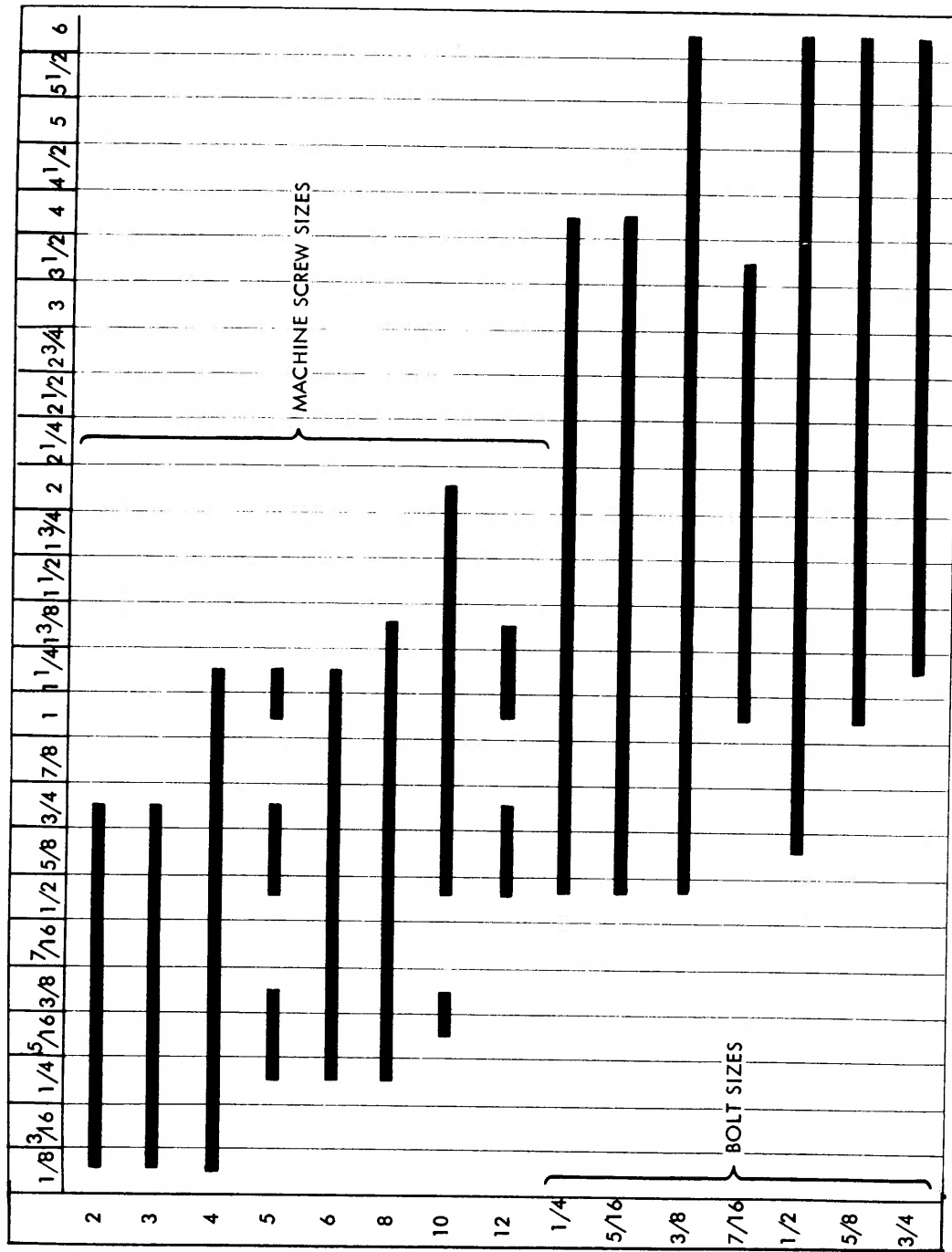
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Table 4-2 Screw Threads per Inch National Fine and Coarse

NO. OR FRACTIONAL SIZE	THREADS PER INCH		NO. OR FRACTIONAL SIZE	THREADS PER INCH	
	FINE	COARSE		FINE	COARSE
0(0.080)	80	--	9/16	18	12
1(0.073)	72	64	5/8	18	11
2(0.086)	64	56	3/4	16	10
3(0.099)	56	48	7/8	14	9
4(0.112)	48	40	1	14	8
5(0.125)	44	40	1-1/8	12	7
6(0.138)	40	32	1-1/4	12	7
8(0.164)	36	32	1-1/2	12	6
10(0.190)	32	24	1-3/4	12	5
12(0.216)	28	24	2	12	4-1/2
1/4	28	20	2-1/4	12	4-1/2
5/16	24	18	2-1/2	12	4
3/8	24	16	2-3/4	12	4
7/16	20	14	3	10	4
1/2	20	13			

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Table 4-3. Brass Machine Screws and Bolt Lengths



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Table 4-4. Standard Wire and Sheet Metal Gages

GAGE NO.	AMERICAN OR B & S (NOTE 1)	U. S. STANDARD (NOTE 2)	BIRMINGHAM OR STUBS (NOTE 3)
1	.2893	.28125	.300
2	.2576	.265625	.284
3	.2294	.25	.259
4	.2043	.234375	.238
5	.1819	.21875	.220
6	.1620	.203125	.203
7	.1443	.1875	.180
8	.1285	.171875	.165
9	.1144	.15625	.148
10	.1019	.140625	.134
11	.09074	.125	.120
12	.08081	.109375	.109
13	.07196	.09375	.095
14	.06408	.078125	.083
15	.05707	.0703125	.072
16	.05082	.0625	.065
17	.04526	.05625	.058
18	.04030	.05	.049
19	.03589	.04375	.042
20	.03196	.0375	.035
21	.02846	.034375	.032
22	.02535	.03125	.028
23	.02257	.028125	.025
24	.02010	.025	.022
25	.01790	.021875	.020
26	.01594	.01875	.018
27	.01420	.0171875	.016
28	.01264	.015625	.014
29	.01126	.0140625	.013
30	.01003	.0125	.012
31	.008928	.0109375	.010
32	.007950	.01015626	.009
33	.007080	.009375	.008
34	.006350	.00859375	.007
35	.005615	.0078125	.005
36	.005000	.00703125	.004
37	.004453	.006640626	----
38	.003965	.00625	----
39	.003531	-----	----
40	.003145	-----	----
NOTE 1: Used for aluminum, copper, brass, and nonferrous alloy sheets, wire, and rods.			
NOTE 2: Used for iron, steel, nickel, and ferrous alloy sheets, wire, and rods.			
NOTE 3: Used for seamless tubes; also by some manufacturers for copper and brass.			

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Table 4-5. Tap Drill Sizes - Machine Screws

SIZE	THREADS/IN	SERIES	TAP DRILL	CLEARANCE DRILL
0	80	NF	$\frac{7}{64}$. 56	$\frac{7}{64}$. 52
1	64	NC	$\frac{7}{64}$. 53	$\frac{7}{64}$. 48
	72	NF	$\frac{7}{64}$. 53	$\frac{7}{64}$. 48
2	56	NC	$\frac{7}{64}$. 50	$\frac{7}{64}$. 43
	64	NF	$\frac{7}{64}$. 50	$\frac{7}{64}$. 43
3	48	NC	$\frac{7}{64}$. 47	$\frac{7}{64}$. 38
	56	NF	$\frac{7}{64}$. 45	$\frac{7}{64}$. 38
4	40	NC	$\frac{7}{64}$. 43	$\frac{7}{64}$. 32
	48	NF	$\frac{7}{64}$. 42	$\frac{7}{64}$. 32
5	40	NC	$\frac{7}{64}$. 38	$\frac{7}{64}$. 30
	44	NF	$\frac{7}{64}$. 37	$\frac{7}{64}$. 30
6	32	NC	$\frac{7}{64}$. 36	$\frac{7}{64}$. 27
	40	NF	$\frac{7}{64}$. 33	$\frac{7}{64}$. 27
8	32	NC	$\frac{7}{64}$. 29	$\frac{7}{64}$. 18
	36	NF	$\frac{7}{64}$. 29	$\frac{7}{64}$. 18
10	24	NC	$\frac{7}{64}$. 25	$\frac{7}{64}$. 9
	32	NF	$\frac{7}{64}$. 21	$\frac{7}{64}$. 9

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Table 4-6. Tap Drill Sizes - Pipe

SIZE (NORMAL)	OD (ACTUAL)	THREADS PER INCH	TAP DRILL	CLEARANCE DRILL
$\frac{1}{8}$	.405	27	$\frac{11}{32}$	$\frac{7}{16}$
$\frac{1}{4}$	.540	18	$\frac{7}{16}$	$\frac{9}{16}$
$\frac{3}{8}$	.675	18	$\frac{37}{64}$	$\frac{3}{4}$
$\frac{1}{2}$	.84	14	$\frac{23}{32}$	$\frac{7}{8}$
$\frac{3}{4}$	1.05	14	$\frac{59}{64}$	$\frac{13}{16}$
1	1.315	11-1/2	$\frac{15}{32}$	$\frac{17}{16}$
1-1/4	1.66	11-1/2	1-1/2	1-3/4
1-1/2	1.9	11-1/2	1-87/64	2
2	2.375	11-1/2	2-7/32	2-1/2
2-1/2	2.875	8	2-5/8	3
3	3.5	8	3-1/4	3-3/4
3-1/2	4.0	8	3-3/4	4-1/4
4	4.5	8	4-1/4	4-3/4

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Table 4-7. Tap Drill Sizes - Bolts

SIZE	THREAD/IN	SERIES	TAP DRILL	CLEARANCE DRILL
1/4	20	NC	No. 7	17/64
	28	NF	No. 3	17/64
5/16	18	NC	No. F	21/64
	24	NF	No. I	21/64
3/8	16	NC	5/16	25/64
	24	NF	No. Q	25/64
7/16	14	NC	No. V	29/64
	20	NF	25/64	29/64
1/2	13	NC	27/64	17/32
	20	NF	29/64	17/32
9/16	12	NC	31/64	19/32
	18	NF	33/64	19/32
5/8	11	NC	17/32	21/32
	18	NF	37/64	21/32
3/4	10	NC	21/32	25/32
	16	NF	11/16	25/32
7/8	9	NC	49/64	29/32
	14	NF	13/16	29/32

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Table 4-8. Hexagonal Nuts - Dimensions

THREAD SIZE	WIDTH ACROSS FLATS	HEIGHT STANDARD	THREAD SIZE	WIDTH ACROSS FLATS	HEIGHT STANDARD
0	5/32	3/64	5/16	1/2	17/64
1	5/32	3/64	3/8	9/16	21/64
2	3/16	1/16	7/16	11/16	3/8
3	3/16	1/16	1/2	3/4	7/16
4	1/4	3/32	9/16	7/8	31/64
5	5/16	7/64	5/8	15/16	35/64
6	5/16	7/64	3/4	1-1/8	41/64
8	11/32	1/8	7/8	1-5/16	3/4
10	3/8	1/8	1	1-1/2	55/64
1/4	7/16	7/32			

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Table 4-9. Decimal Equivalent of Tool Sizes
(Sheet 1 of 4)

INCH	MM	WIRE GAGE	DECIMALS OF AN INCH	INCH	MM	WIRE GAGE	DECIMALS OF AN INCH	INCH	MM	WIRE GAGE	DECIMALS OF AN INCH
1/64	.4	80	.0135	1/16	1.6		.0625	9/64	3.3	30	.1285
		79	.0145			52	.062992				.129921
			.015625				.0635			29	.133858
			.015748				.06496				.136
		78	.016			51	.066929			28	.137795
		77	.018				.067				.1405
			.019685			50	.068897				.140625
		76	.02				.07				.141732
		75	.021				.070866			27	.144
			.021653			49	.072834				.145669
			.0225				.073			26	.147
		74	.023622			48	.074803				.147637
			.024				.076			25	.1495
		73	.025				.076771				.149606
		72	.02559							24	.152
			.026			5/64	.078125			3.9	.153543
1/32	.8	71	.027559		2	47	.0785	5/32	4	23	.154
			.028				.07874				.15625
		70	.02925			46	.080708			22	.157
		69	.029527			45	.081				.15748
		68	.031				.082			21	.159
			.03125				.082677			20	.161
			.031496			44	.084645			4.1	.161417
		67	.032				.086			4.2	.16354
		66	.033				.086614			19	.166
			.033464			43	.088582			4.25	.167322
		65	.035				.089			4.3	.169291
			.035433				.090551			18	.1695
		64	.036			42	.092519			11/64	.171875
		63	.037				.0935			17	.173
			.037401			3/32	.09375			4.4	.173228
3/64	1.2	62	.038		2.4	41	.094488			16	.177
		61	.039				.096			4.5	.177165
			.03937			40	.096456			15	.18
		60	.04				.098			4.6	.181102
			.041			39	.098425			14	.182
			.041338			38	.0995			13	.185
		58	.042				.1015			4.7	.185039
		57	.043				.1015			4.75	.187007
			.043307			37	.102362			3/16	.1875
			.045275			36	.104			4.8	.188976
		56	.0465				.106299				.189
			.046875				.1065			12	.191
			.047244			7/64	.108267			11	.192913
			.049212				.109375			10	.1935
			.051181			35	.11			9	.196
		55	.052				.110236			8	.19685
			.053149			34	.111				.199
		54	.055			33	.113			5.1	.200787
			.055118				.114173			7	.201
			.057086			32	.116			13/64	.203125
1/8	1.5		.059055		3	31	.11811			6	.204
			.0595				.12			5.2	.204724
			.061023				.122047			5	.2055
							.125				.206692
							.125984			5.3	.208661
							.127952			4	.209

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Table 4-9. Decimal Equivalent of Tool Sizes
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INCH	MM	WIRE GAGE	DECIMALS OF AN INCH	INCH	MM	WIRE GAGE	DECIMALS OF AN INCH	INCH	MM	DECIMALS OF AN INCH
7/32	5.4	3	.212598	5/16	8	O	.3125	35/64	13.5	.531495
			.213				.31496			.546875
	5.5		.216535				.316		14	.55118
		2	.21875		8.1	P	.318897	9/16		.5625
	5.6		.220472				.322834		14.5	.570865
			.221				.323		37/64	.578125
	5.7	1	.224409		8.25	Q	.324802	19/32	15	.59055
7/32	5.75		.226377				.326771			.59375
			.228	21/64	8.3	R	.328125	39/64		.609375
	5.8		.228346				.330708		15.5	.610235
							.332		5/8	.625
					8.5	S	.334645	41/64	16	.62992
							.338582			.640625
							.339		16.5	.649605
INCH	MM	LETTER SIZES	DECIMALS OF AN INCH	INCH	MM	LETTER SIZES	DECIMALS OF AN INCH	INCH	MM	DECIMALS OF AN INCH
15/64	5.9	A	.232283	11/32	8.6	T	.342519	21/32	17	.66929
			.234				.34375			.671875
			.234375				.344487		43/64	.6875
	6	B	.23622		8.7	U	.346456	11/16	17.5	.688975
			.238				.348			.703125
	6.1		.240157				.350393		18	.70866
		C	.242	23/64	8.8	V	.35433	23/32		.71875
1/4	6.2		.244094				.358		18.5	.728345
			.246				.358267	47/64		.734375
	6.25	D	.246062		9	W	.359375		19	.74803
			.248031				.362204			.75
	6.3		.25				.364172	3/4		.765625
		E	.251968		9.1	X	.366141		49/64	.767715
	6.4		.255905				.368		19.5	.78125
17/64	6.5	F	.257		9.2	Y	.370078	25/32	20	.7874
			.259842				.374015			.796875
	6.6		.261				.375		51/64	.807085
		G	.263779	3/8	9.3	Z	.377	13/16	20.5	.8125
	6.7		.265625				.377952			.82677
			.265747				.381889		21	.828125
	6.75	H	.266				.383857	53/64		.84375
			.267716		9.4	W	.385826		21.5	.846455
	6.8		.271653				.386			.859375
	6.9	I	.272				.389763	27/32		.86614
9/32	7		.27559		9.5	X	.390625		22	.875
			.277				.3937	7/8		.885825
	7.1	J	.279527				.397		22.5	.890625
			.281	25/64	10	Y	.404	57/64	23	.90551
			.28125				.40625			.90625
	7.2	K	.283464				.413		29/32	.921875
	7.25		.285432		10.5	Z	.413385	59/64		.925195
			.287401				.421875		23.5	.9375
	7.3	L	.29				.43307			.94488
19/64	7.4		.291338		7/16	11	.4375	61/64	24	.953125
			.295				.452755			.964565
	7.5	M	.295275				.453125		24.5	.96875
			.296875	29/64	11.5	12	.46875	31/32	25	.98425
	7.6		.299212				.47244			.984375
		N	.302				.484375	63/64		1.
	7.7		.303149		12.5	13	.492125		25.5	1.003935
	7.75		.305117				.5			1.015625
19/64	7.8		.307086		17/32		.51181	1-1/64	26	1.02362
	7.9		.311023				.515625			1.03125
							.53125	1-1/32		

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Table 4-9. Decimal Equivalent of Tool Sizes
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INCH	MM	DECIMALS OF AN INCH	INCH	MM	DECIMALS OF AN INCH	INCH	MM	DECIMALS OF AN INCH
	26.5	1.043305		39.5	1.555115		52.5	2.066925
1-3/64		1.046875	1-9/16		1.5625	2-5/64		2.078125
1-1/16		1.0625		40	1.5748		53	2.08661
	27	1.06299	1-37/64		1.578125	2-3/32		2.09375
1-5/64		1.078125	1-19/32		1.59375		53.5	2.106295
	27.5	1.082675		40.5	1.594485	2-7/64		2.109375
1-3/32		1.09375	1-39/64		1.609375	2-1/8		2.125
	28	1.10236		41	1.61417		54	2.12598
1-7/64		1.109375	1-5/8		1.625	2-9/64		2.140625
	28.5	1.122045		41.5	1.633855		54.5	2.145665
1-1/8		1.125	1-41/64		1.640625	2-5/32		2.15625
1-9/64		1.140625		42	1.65354		55	2.16535
	29	1.14173	1-21/32		1.65625	2-11/64		2.171875
1-5/32		1.15625	1-43/64		1.671875		55.5	2.185035
	29.5	1.161415		42.5	1.673225	2-3/16		2.1875
1-11/64		1.171875	1-11/16		1.6875	2-13/64		2.203125
	30	1.1811		43	1.69291		56	2.20472
1-3/16		1.1875	1-45/64		1.703125	2-7/32		2.21875
	30.5	1.200785		43.5	1.712595		56.5	2.224405
1-13/64		1.203125	1-23/32		1.71875	2-15/64		2.234375
1-7/32		1.21875		44	1.73228		57	2.24409
	31	1.22047	1-47/64		1.734375	2-1/4		2.25
1-15/64		1.234375	1-3/4		1.75		57.5	2.263775
	31.5	1.240155		44.5	1.751965	2-17/64		2.265625
1-1/4		1.25	1-49/64		1.765625	2-9/32		2.28125
	32	1.25984		45	1.77165		58	2.28346
1-17/64		1.265625	1-25/32		1.78125	2-19/64		2.296875
	32.5	1.279525		45.5	1.791335		58.5	2.303145
1-9/32		1.28125	1-51/64		1.796875	2-5/16		2.3125
1-19/64		1.296875		46	1.81102		59	2.32283
	33	1.29921*	1-13/16		1.8125	2-21/64		2.328125
1-5/16		1.3125	1-53/64		1.828125		59.5	2.342515
	33.5	1.318895		46.5	1.830705	2-11/32		2.34375
1-21/64		1.328125	1-27/32		1.84375	2-23/64		2.359375
	34	1.33858		47	1.85039		60	2.3622
1-11/32		1.34375	1-55/64		1.859375	2-3/8		2.375
	34.5	1.358265		47.5	1.870075		60.5	2.381885
1-23/64		1.359375	1-7/8		1.875	2-25/64		2.390625
1-3/8		1.375		48	1.88976		61	2.40157
	35	1.37795	1-57/64		1.890625	2-13/32		2.40625
1-25/64		1.390625	1-29/32		1.90625		61.5	2.421255
	35.5	1.397635		48.5	1.909445	2-27/64		2.421875
1-13/32		1.40625	1-59/64		1.921875	2-7/16		2.4375
	36	1.41732		49	1.92913		62	2.44094
1-27/64		1.421875	1-15/16		1.9375	2-29/64		2.453125
	36.5	1.437005		49.5	1.948815		62.5	2.460625
1-7/16		1.4375	1-61/64		1.953125	2-15/32		2.46875
1-29/64		1.453125		50	1.9685		63	2.48031
	37	1.45669	1-31/32		1.96875	2-31/64		2.484375
1-15/32		1.46875	1-63/64		1.984375		63.5	2.499995
	37.5	1.476375		50.5	1.988185	2-1/2		2.5
1-31/64		1.484375	2		2.	2-23/64		2.515625
	38	1.49606		51	2.00787		64	2.51968
1-1/2		1.5	2-1/64		2.015625	2-17/32		2.53125
1-33/64		1.515625		51.5	2.027555		64.5	2.539365
	38.5	1.515745	2-1/32		2.03125	2-35/64		2.546875
1-17/32		1.53125	2-3/64		2.046875		65	2.55905
	39	1.53543		52	2.04724	2-9/16		2.5625
1-35/64		1.546875	2-1/16		2.0625	2-37/64		2.578125

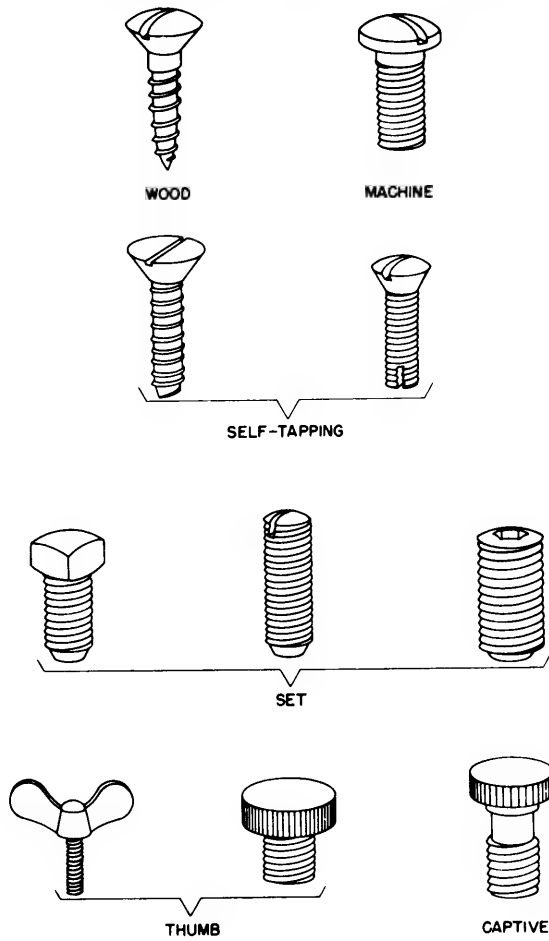
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Table 4-9. Decimal Equivalent of Tool Sizes
(Sheet 4 of 4)

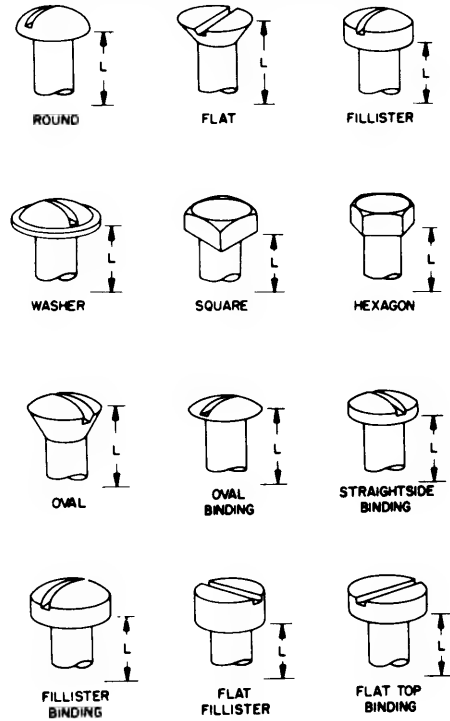
INCH	MM	DECIMALS OF AN INCH	INCH	MM	DECIMALS OF AN INCH	INCH	MM	DECIMALS OF AN INCH
2-19/32	65.5	2.578735	2-41/64	67	2.63779	2-11/16	68	2.67716
		2.59375			2.640625			2.6875
	66	2.59842	2-21/32		2.65625		68.5	2.696845
2-35/64		2.609375		67.5	2.657475	2-45/64		2.703125
	66.5	2.618105	2-43/64		2.671875		69	2.71653
2-5/8		2.625						

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TYPICAL SCREW TYPES



HEAD TYPES FOR BOLTS AND SCREWS



LENGTHS ARE SPECIFIED BETWEEN POINTS INDICATED BY ARROWS.

RECESSED DRIVES

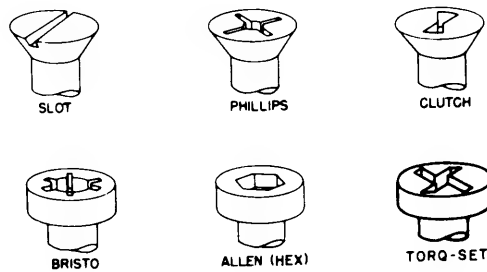


Figure 4-1. Types of Screws

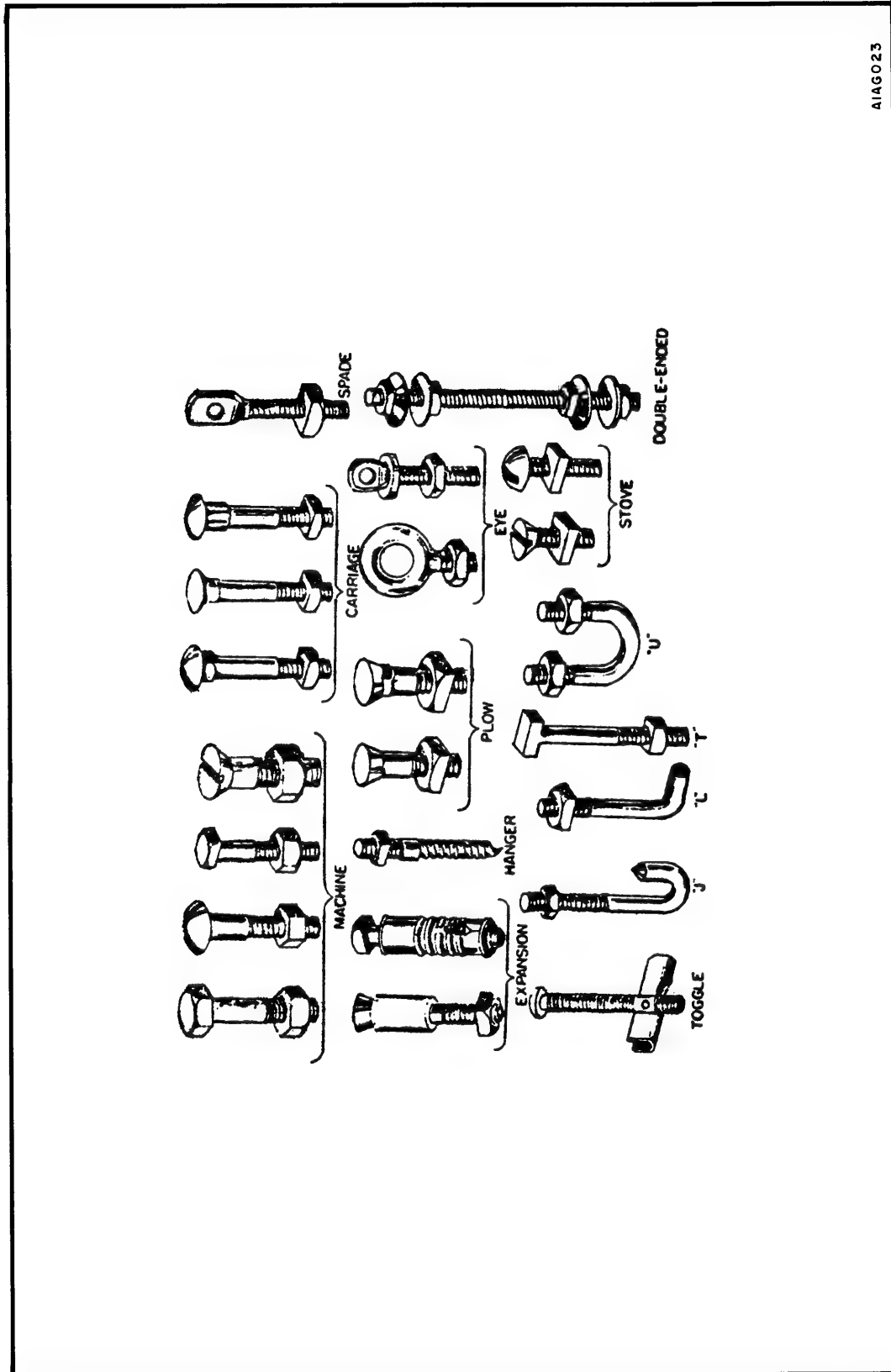


Figure 4-2. Types of Bolts

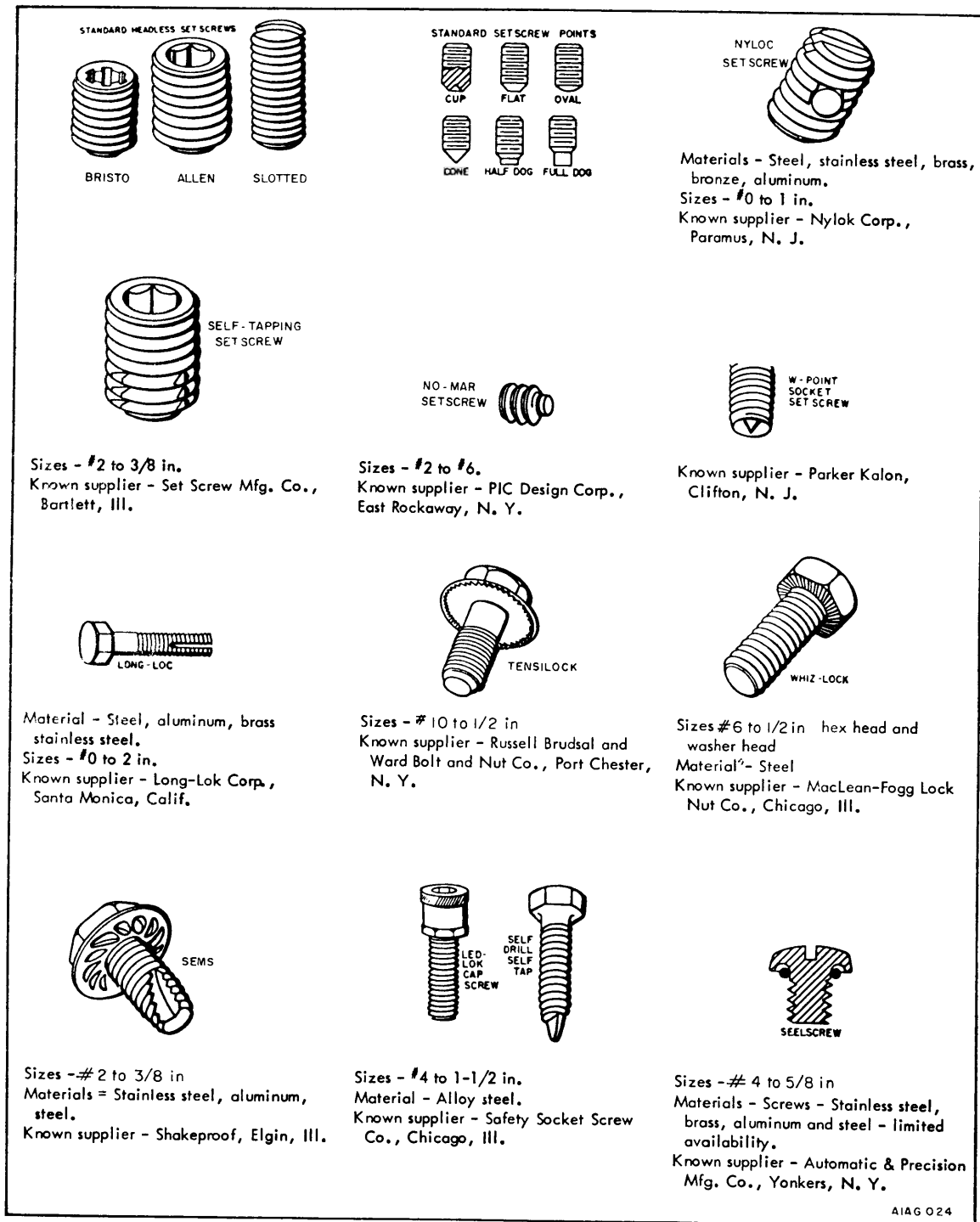


Figure 4-3. Set Screws

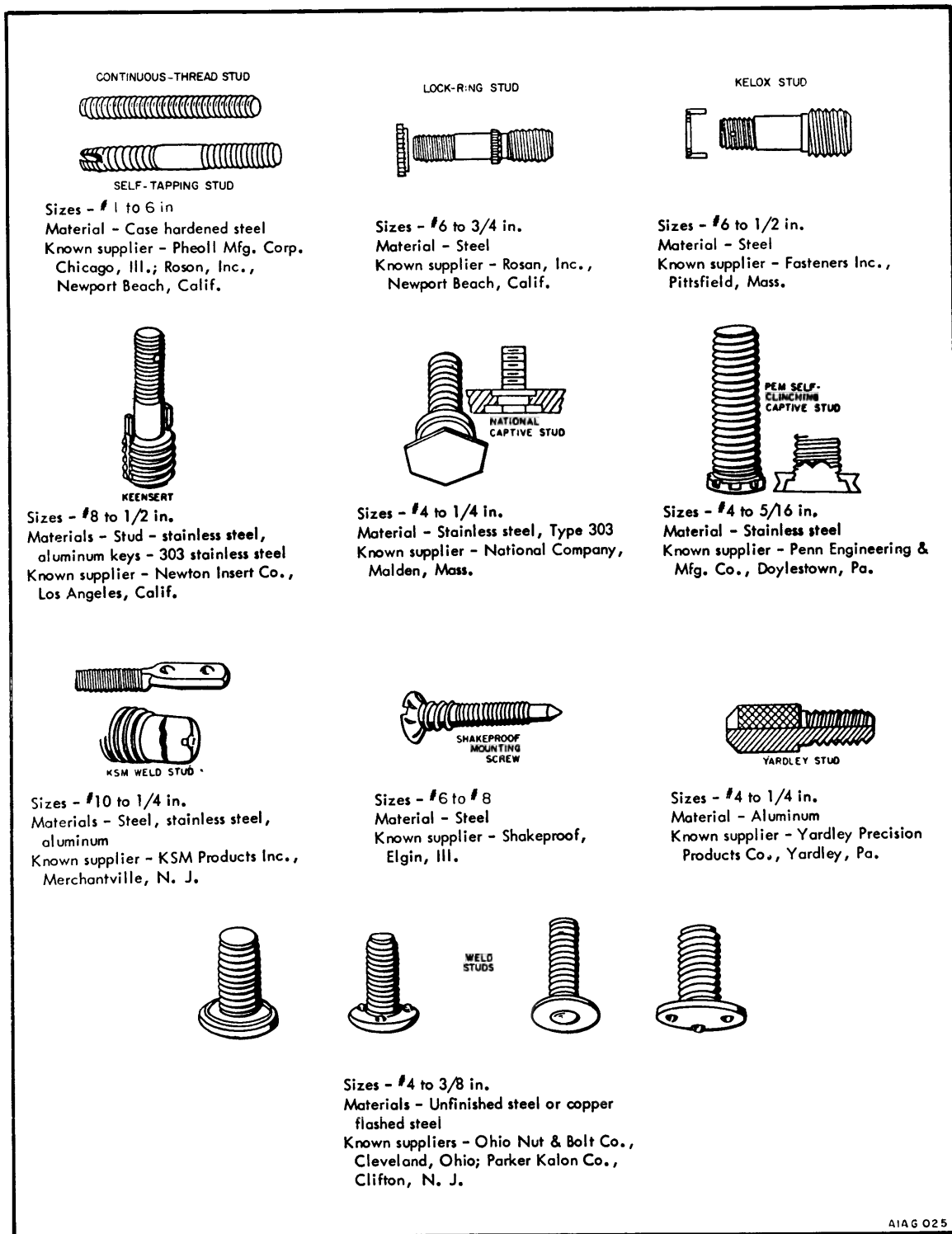


Figure 4-4. Threaded Studs



Figure 4-5. Nuts (Sheet 1 of 3)

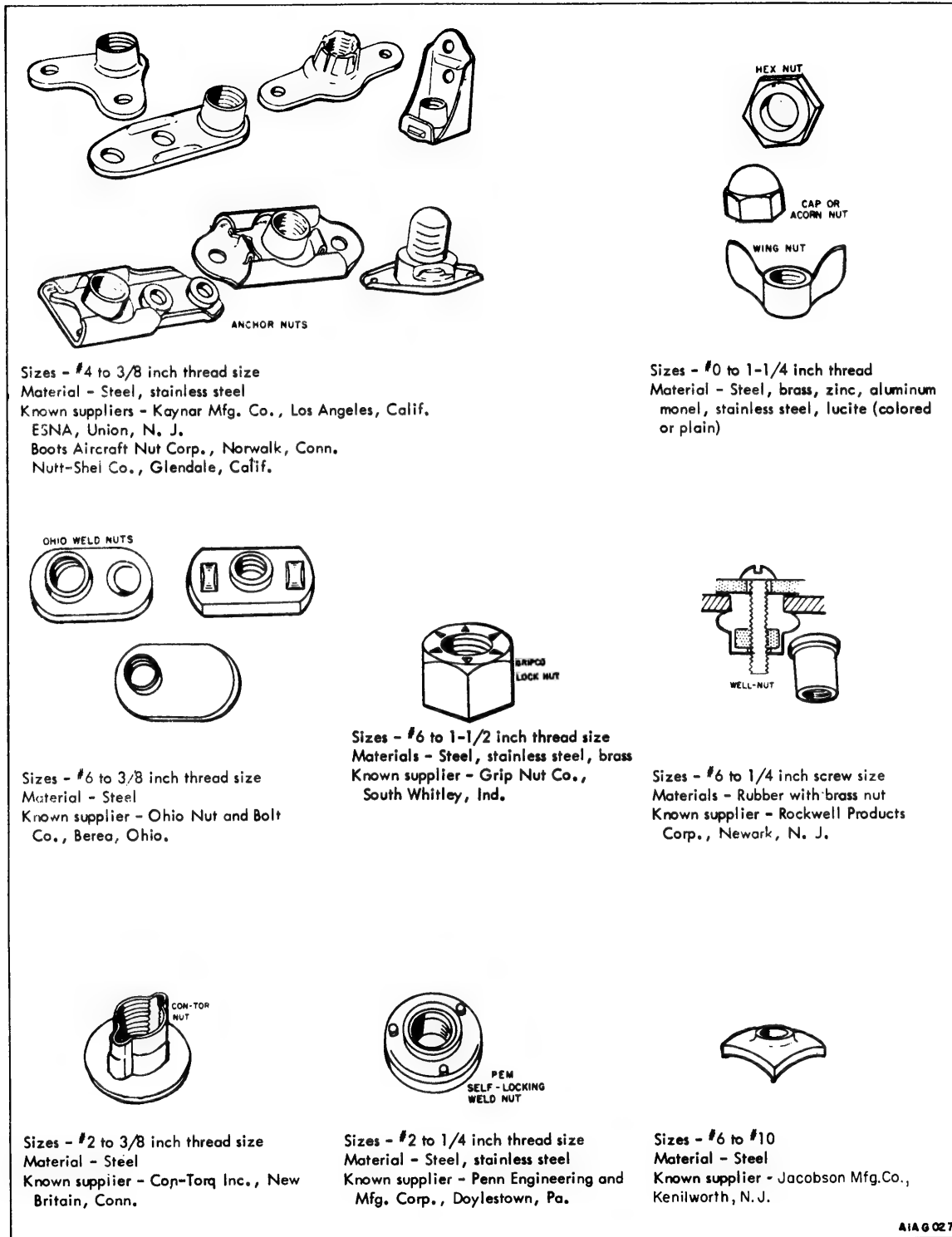
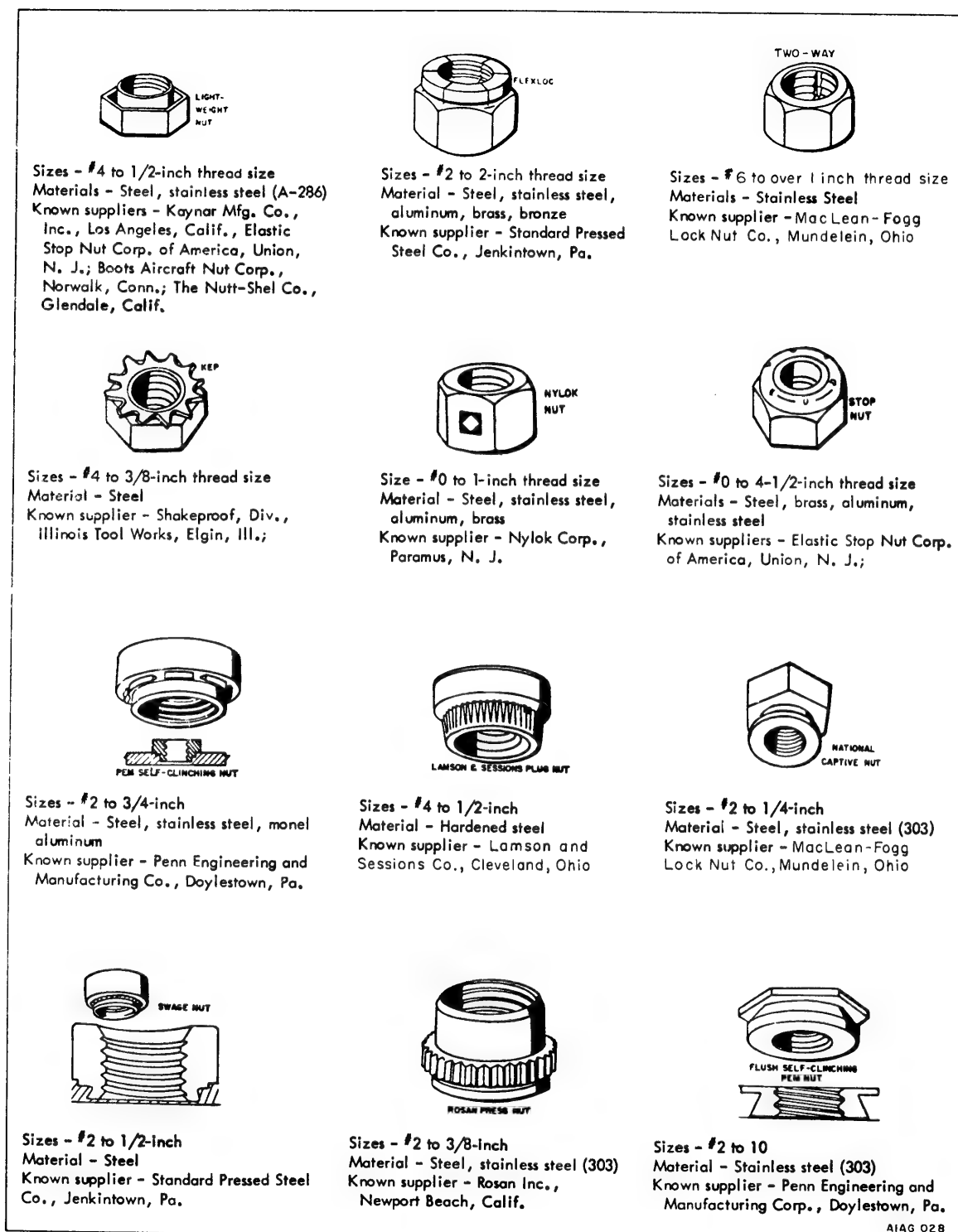


Figure 4-5. Nuts (Sheet 2 of 3)



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Figure 4-5. Nuts (Sheet 3 of 3)

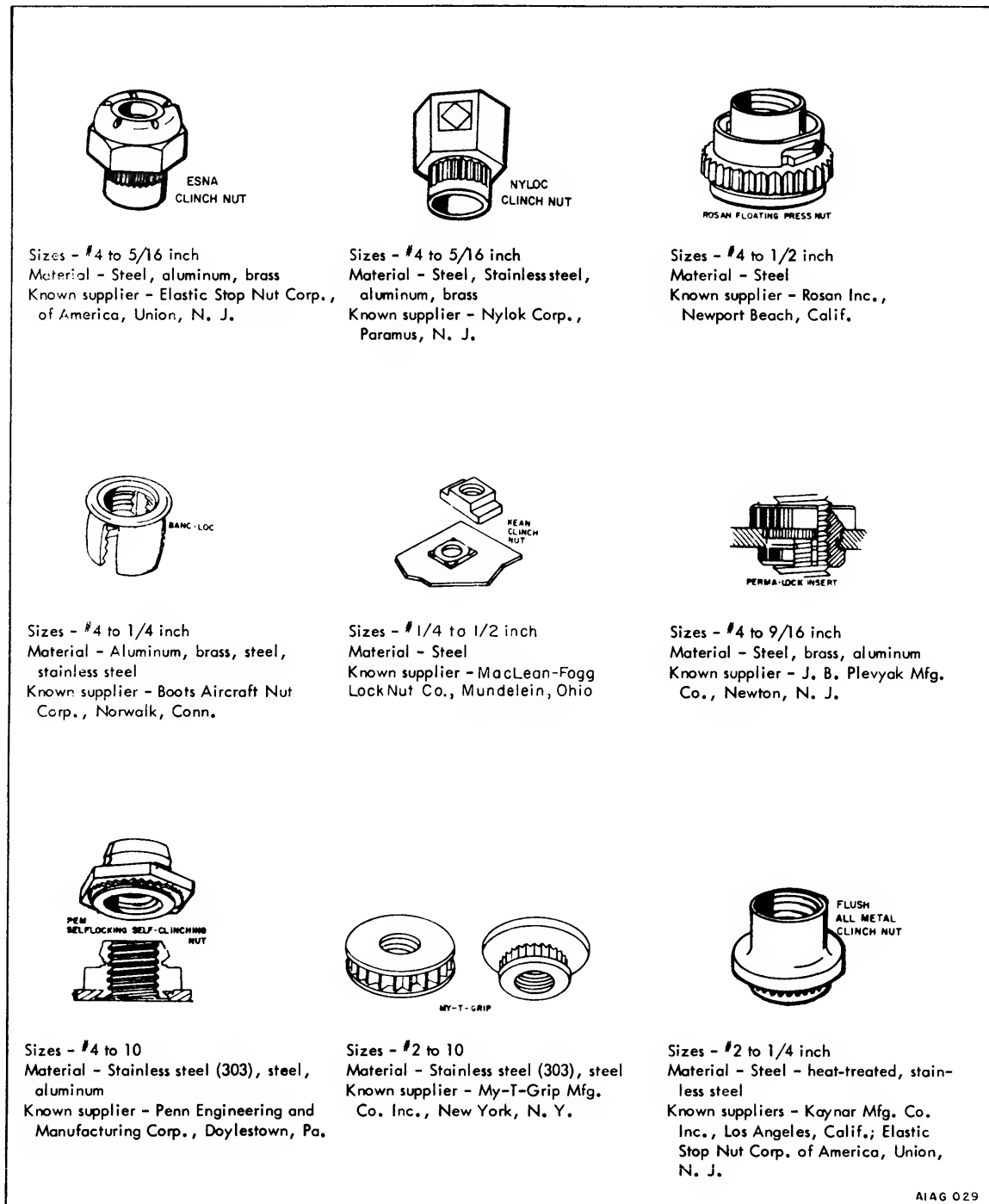


Figure 4-6. Clinch Nuts

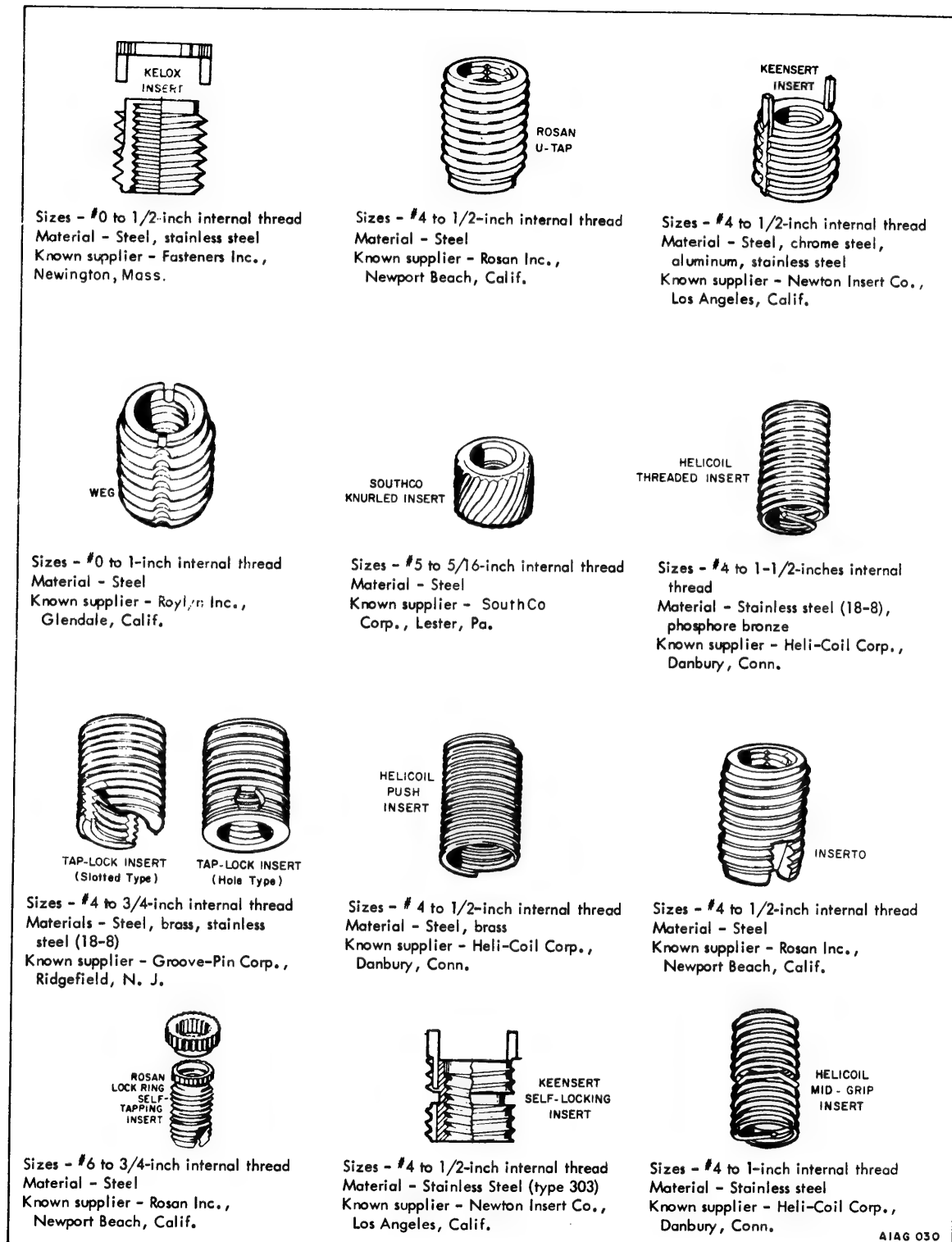


Figure 4-7. Inserts (Sheet 1 of 2)

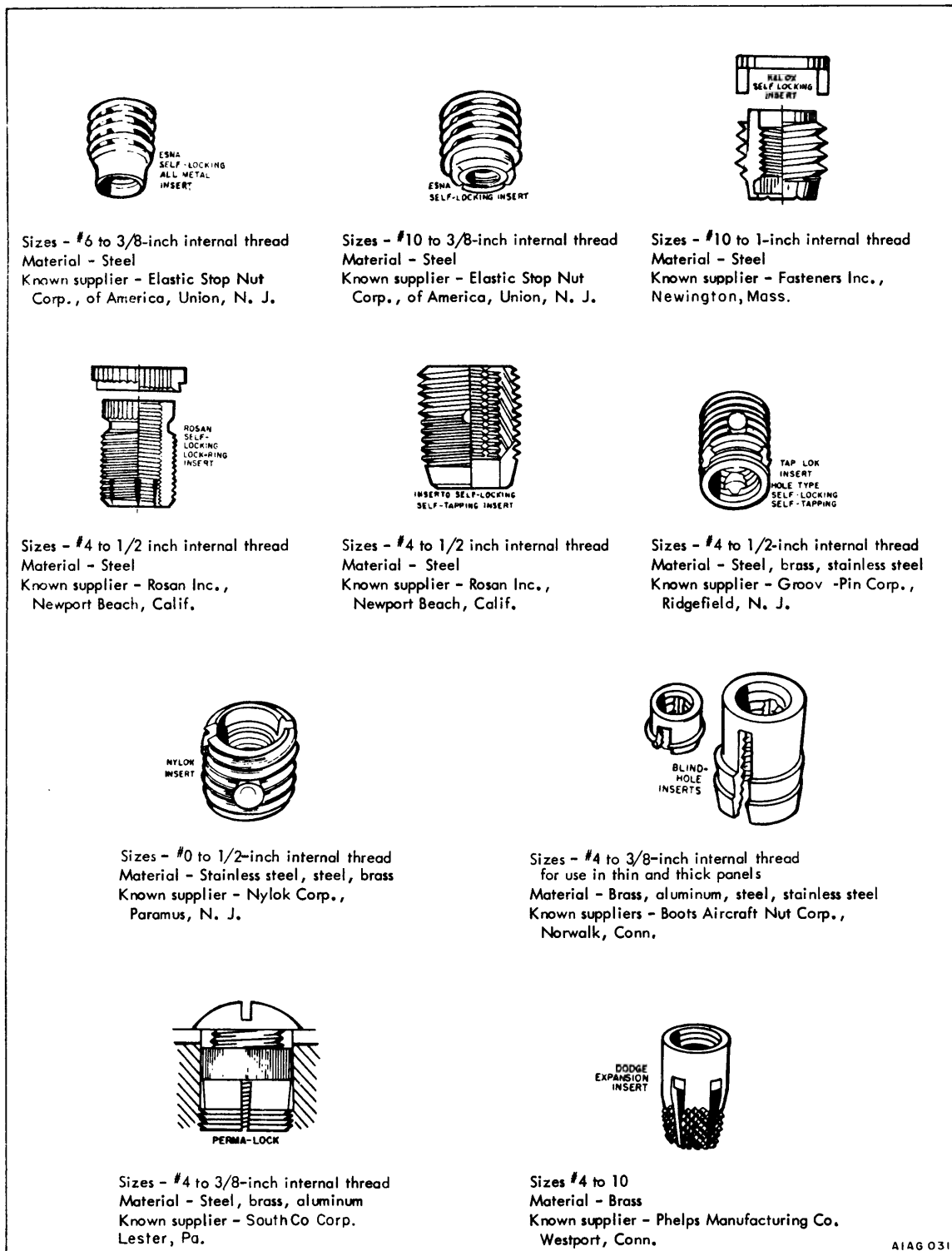


Figure 4-7. Inserts (Sheet 2 of 2)

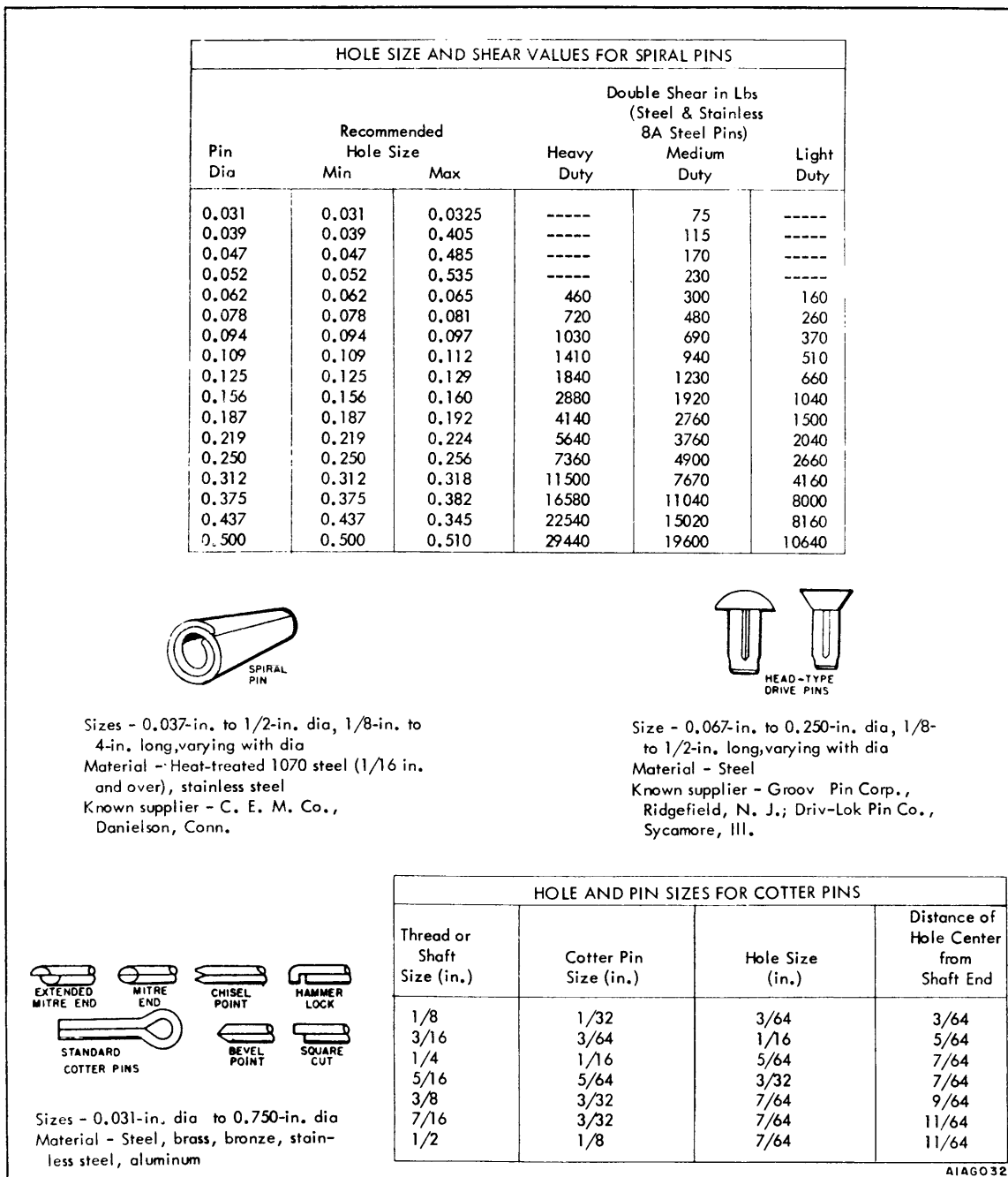
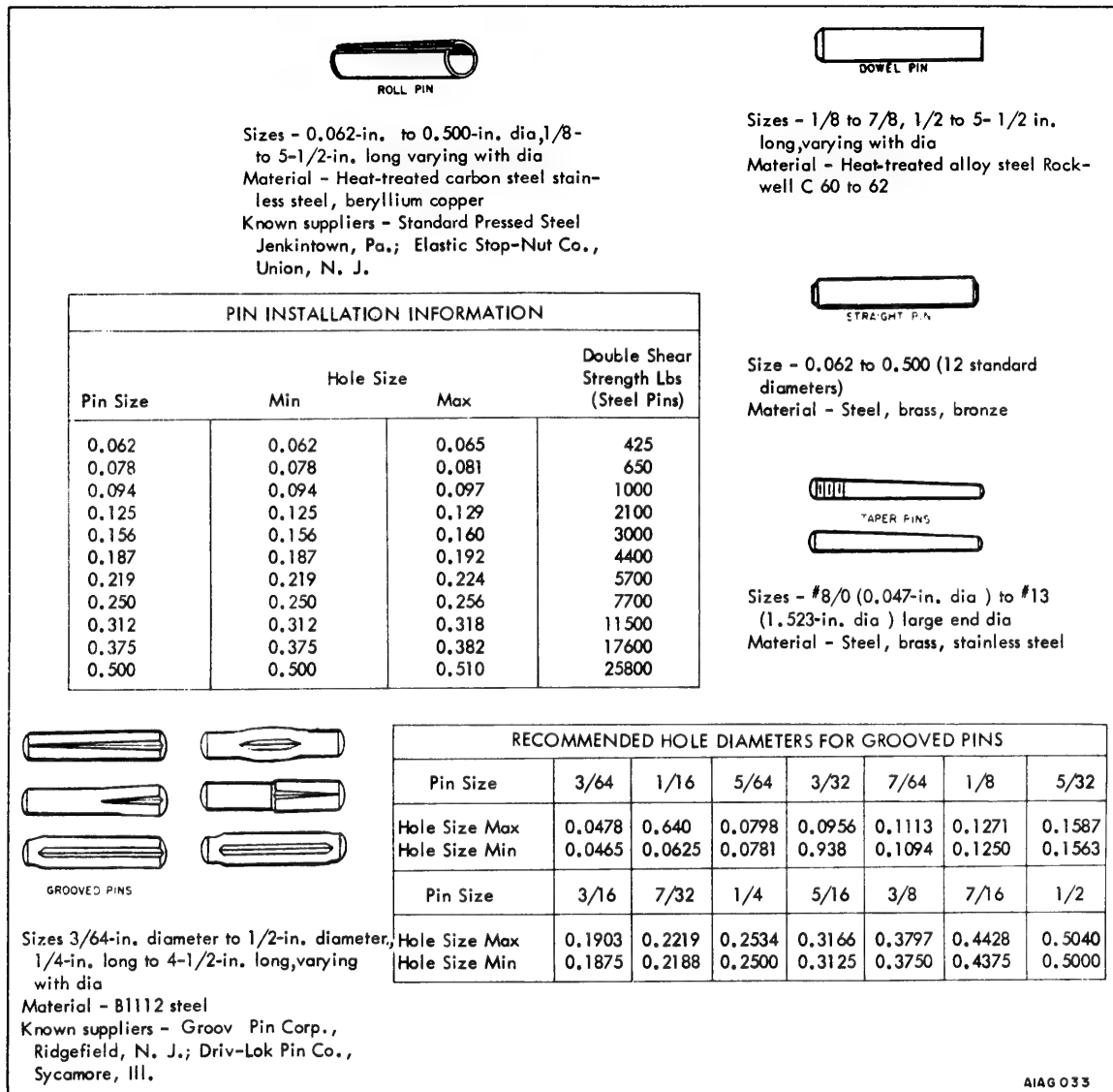
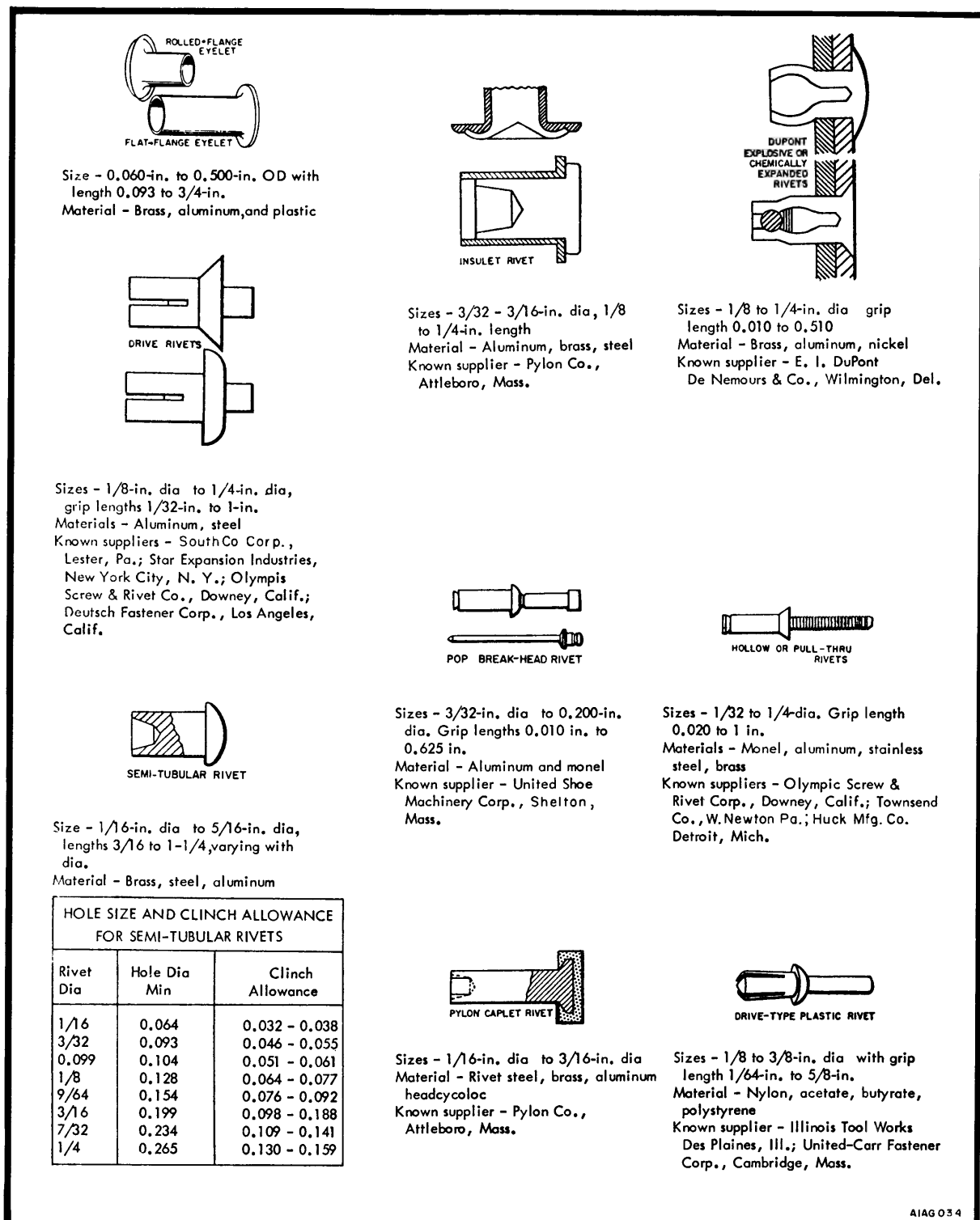


Figure 4-8. Pins (Sheet 1 of 2)



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Figure 4-8. Pins (Sheet 2 of 2)



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Figure 4-9. Rivets (Sheet 1 of 2)

SOLID RIVETS

Sizes - 1/16-in. to 7/16-in. dia
1/8-in. to 4-in. long, varying with
dia
Material - Steel, Stainless steel, brass,
copper, monel, aluminum

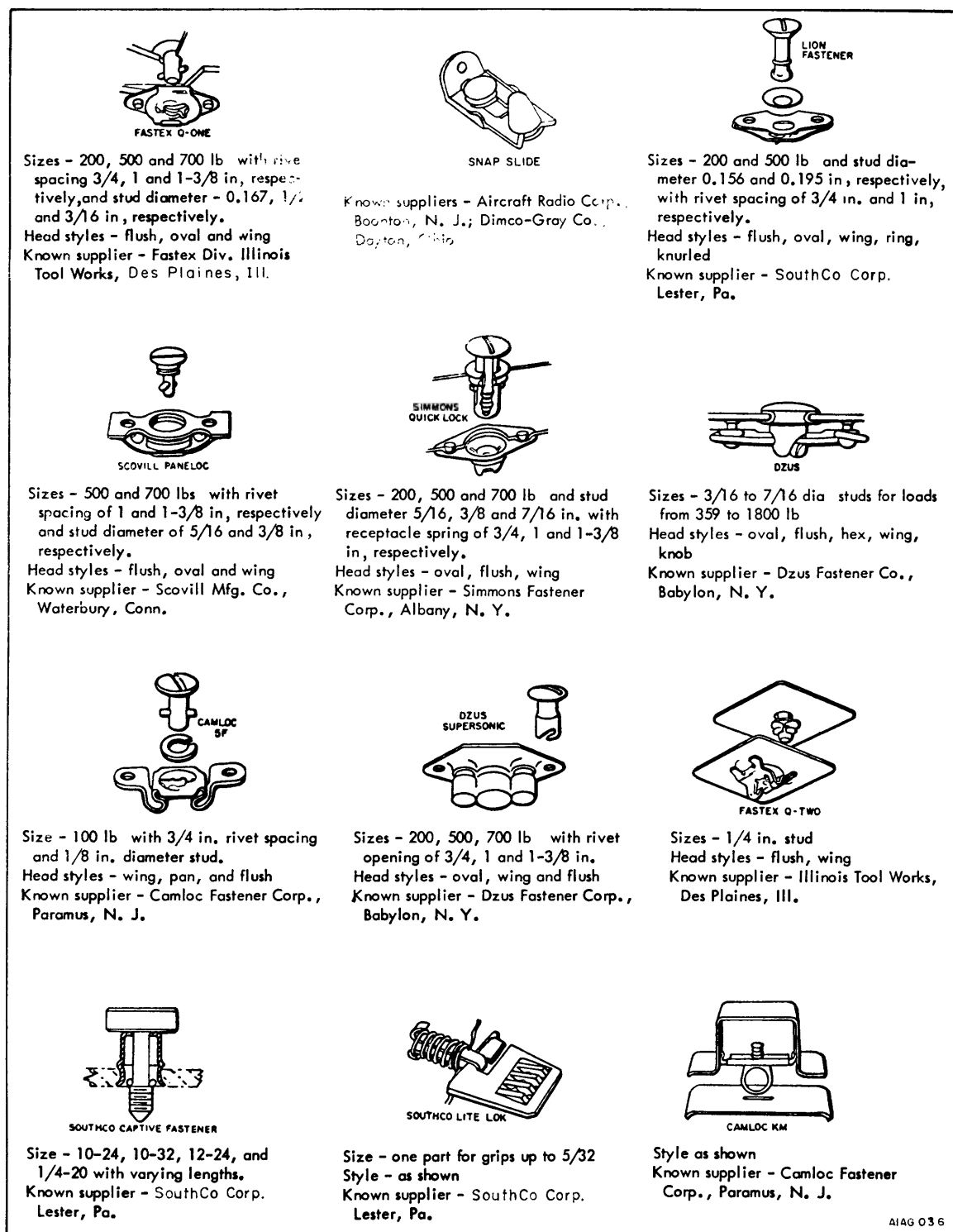
Rivet Hole Sizes		
Rivet Size	Hole Size	
	Min	Max
3/32	0.093	0.096
1/8	0.128	0.134
5/32	0.160	0.167
3/16	0.191	0.199
1/4	0.255	0.264

Solid Rivet Dimensions

Max Head Diameter						Max Head Height				
Body Dia	Flat HD	CSK HD	Button HD	Pan HD	Truss HD	Flat HD	CSK HD	Button HD	Pan HD	Truss HD
1/16	0.140	0.118	0.122	0.118	-----	0.027	0.027	0.052	0.040	-----
3/32	0.200	0.176	0.182	0.173	0.226	0.038	0.040	0.077	0.060	0.038
1/8	0.260	0.235	0.235	0.225	0.297	0.048	0.053	0.100	0.078	0.048
5/32	0.323	0.293	0.290	0.279	0.368	0.059	0.066	0.124	0.096	0.059
3/16	0.307	0.351	0.348	0.334	0.442	0.069	0.079	0.147	0.114	0.069
7/32	0.453	0.413	0.405	0.391	0.515	0.080	0.094	0.172	0.133	0.080
1/4	0.515	0.469	0.460	0.444	0.590	0.091	0.106	0.196	0.151	0.091

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Figure 4-9. Rivets (Sheet 2 of 2)



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Figure 4-10. Fasteners (Sheet 1 of 2)

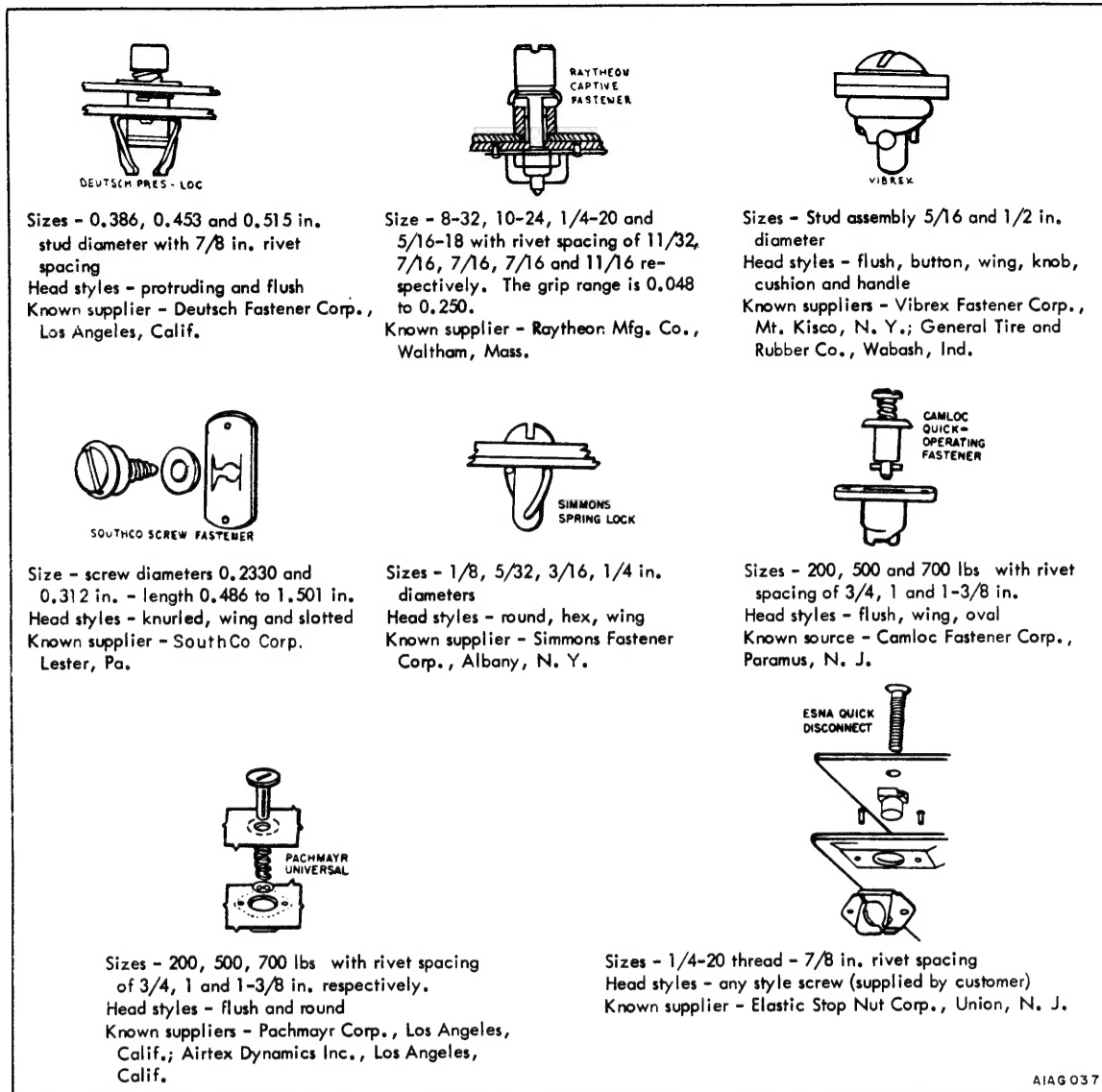


Figure 4-10. Fasteners (Sheet 2 of 2)

		FLAT WASHER DIMENSIONS (ASA-B-27-2)						
	Size	#0	#2	#4	#6	#8	#10	1/4
		0.060	0.086	0.112	0.138	0.164	0.190	0.250
O. D. Max	I. D. Min	0.063	0.089	0.120	0.151	0.183	0.203	0.271
	Small Pattern	0.130	0.193	0.255	0.318	0.380	0.411	0.505
	Regular Pattern	0.193	0.255	0.380	0.443	0.505	0.568	0.744
Thickness Max	Small Pattern	0.028	0.028	0.036	0.036	0.045	0.045	0.071
	Regular Pattern	0.028	0.028	0.045	0.045	0.045	0.045	0.071

		DIMENSIONS OF HELICAL SPRING LOCKWASHERS					
	Size	#2	#4	#6	#8	#10	1/4
		0.86	0.112	0.138	0.164	0.190	0.250
O. D. Max	I. D. Min	0.88	0.115	0.141	0.168	0.194	0.255
	Light Series	0.165	0.202	0.239	0.280	0.323	0.489
	Medium Series	0.175	0.212	0.253	0.296	0.337	0.493
Thickness Max	Light Series	0.015	0.020	0.025	0.031	0.040	0.047
	Medium Series	0.020	0.025	0.031	0.040	0.047	0.062

		DIMENSIONS OF INTERNAL TOOTH LOCKWASHERS					
	Size	#2	#4	#6	#8	#10	1/4
		0.086	0.112	0.138	0.164	0.190	0.250
O. D. Max	I. D. Min	0.089	0.115	0.141	0.168	0.195	0.256
	O. D. Max	0.200	0.270	0.295	0.340	0.381	0.478
	Thickness Max	0.015	0.019	0.021	0.023	0.025	0.028

		DIMENSIONS OF EXTERNAL TOOTH LOCKWASHERS				
	Size	#4	#6	#8	#10	1/4
		0.112	0.138	0.164	0.190	0.250
O. D. Max	I. D. Min	0.115	0.141	0.168	0.195	0.256
	O. D. Max	0.260	0.320	0.381	0.410	0.475
	Thickness Max	0.019	0.022	0.023	0.025	0.028

Figure 4-11. Flat Washer Dimensions

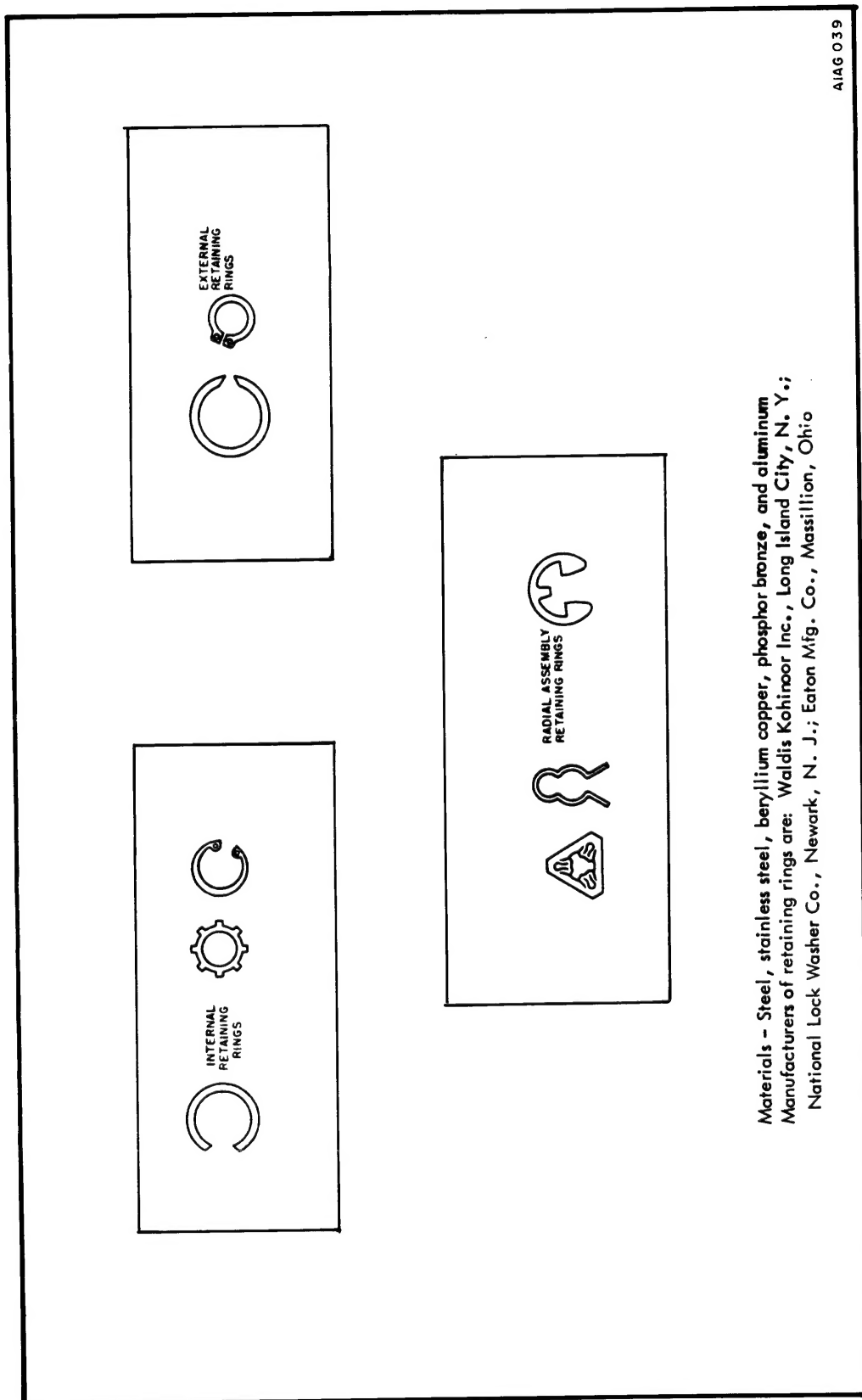


Figure 4-12. Retaining Rings

